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FRICTION STIR GRAIN REFINEMENT OF STRUCTURAL MEMBERS

Abstract of the Disclosure

The present invention provides an improved structural assembly constructed of a plurality of structural members secured together. At least one of the plurality of structural members defines a first region characterized by comparatively high operational stress and a second region having a locally refined grain structure positioned such that the second region at least partially encompasses the first region to thereby enhance the strength, toughness and fatigue resistance of the at least one structural member in the first region. The present invention also provides a method for selectively improving the strength, toughness and fatigue resistance of a structural member in a region of high operational stress including the steps of casting the structural member in a pre-selected configuration. Regions of the structural member having comparatively high operational stress are identified. The structural member is secured to prevent movement. The region of the structural member having comparatively high operational stress is then mixed with a rotating friction stir welding probe to locally refine the grain structure of the structural member within the region of high operational stress to thereby improve the strength, toughness and fatigue resistance of the structural member in the region. The structural member can be secured to other structural members to form the frame of an aircraft. The improved structural assembly will have an increased operational life, as well as require less stock material with a corresponding decrease in the overall weight of the assembly.

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